



US009410082B2

(12) **United States Patent**  
**Morishita et al.**

(10) **Patent No.:** **US 9,410,082 B2**  
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **SEMICONDUCTOR PHOSPHOR  
NANOPARTICLE AND LIGHT-EMITTING  
DEVICE INCLUDING THE SAME**

(71) Applicant: **Sharp Kabushiki Kaisha**, Osaka-shi,  
Osaka (JP)

(72) Inventors: **Mami Morishita**, Osaka (JP); **Tatsuya  
Ryohwa**, Osaka (JP)

(73) Assignee: **Sharp Kabushiki Kaisha**, Osaka (JP)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/534,440**

(22) Filed: **Nov. 6, 2014**

(65) **Prior Publication Data**

US 2015/0144867 A1 May 28, 2015

(30) **Foreign Application Priority Data**

Nov. 25, 2013 (JP) ..... 2013-242530

(51) **Int. Cl.**

<b>H01L 33/06</b>	(2010.01)
<b>C09K 11/62</b>	(2006.01)
<b>C09K 11/02</b>	(2006.01)
<b>C09K 11/70</b>	(2006.01)
<b>C09K 11/88</b>	(2006.01)
<b>H01L 33/50</b>	(2010.01)

(52) **U.S. Cl.**

CPC ..... **C09K 11/62** (2013.01); **C09K 11/025**  
(2013.01); **C09K 11/70** (2013.01); **C09K**  
**11/883** (2013.01); **H01L 33/502** (2013.01)

(58) **Field of Classification Search**

CPC ..... **C09K 11/02**; **C09K 11/025**  
USPC ..... **252/301.36**  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,196,682 B2 \* 11/2015 Jang ..... B82Y 10/00  
2010/0252778 A1 10/2010 Murase et al.

FOREIGN PATENT DOCUMENTS

WO 2009/028282 A1 3/2009

\* cited by examiner

*Primary Examiner* — Mark Prenty

(74) *Attorney, Agent, or Firm* — Keating & Bennett, LLP

(57) **ABSTRACT**

A semiconductor phosphor nanoparticle includes a semicon-  
ductor nanoparticle and a first organic compound. An end of  
the first organic compound is bonded to a surface of the  
semiconductor nanoparticle, and the other end of the first  
organic compound is polymerized to form a first inorganic  
layer.

**5 Claims, 3 Drawing Sheets**

